REMARKS

Upon entry of the above amendment Claims 1-6 will be all the claims pending in the application. New Claim 6 has been added based upon the disclosure, as originally filed, at page 7, lines 7-10.

Substitute Specification

The Examiner has required Applicants to submit a substitute specification. Accordingly, a substitute specification is submitted herewith. A marked up version of the substitute showing all changes is also submitted herewith. This substitute specification does not contain any new matter.

Claim Rejections Under 35 U.S.C. § 102/103

Claims 1-5 has been rejected under 35 U.S.C. § 102(b) as anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as obvious over Mirabella et al (USP 5,426,153).

Examiner's Reasons for Rejection

Regarding claim 1, Examiner states that the presently claimed features (A-1), (A-2), (A-3), (B-1), and (B-2) are expressly disclosed by Mirabella. Although Examiner concedes that Mirabella fails to disclose the presently claimed feature (A-4), Examiner maintains that the feature is inherent to the blend composition of Mirabella because Mirabella's composition is allegedly identical in scope to the presently claimed composition.

Regarding claims 2, 4, and 5, Examiner states that Mirabella discloses the production of film structures. Examiner alleges that the concept of these film structures would embrace gloves or packaging.

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Regarding claim 3, Examiner concedes that Mirabella fails to disclose the particular haze

or gloss values as recited in claim 3. Examiner, however, contends that these particular haze and

gloss values are inherent in the composition disclosed in Mirabella because Mirabella's

composition is allegedly identical in scope to the presently claimed composition.

Applicants' Response

Applicants respectfully traverse the claim rejections under 35 U.S.C. § 102/103.

Applicant's assert that the polymer taught by Mirabella does not inherently satisfy

requirements (A-3) and (A-4).

Claim 1 of the present invention recites a resin composition comprised of two

copolymers, (A) and (B). Copolymer (A) is comprised of an ethylene unit and an α-olefin unit of

3 to 12 carbon atoms and has a density of 880 to 935 kg/m3 (requirement (A-2)). Copolymer (B)

is comprised of an ethylene unit and a unit of a compound having a carbon-carbon double bond

and an oxygen atom. Copolymer (A) comprises 1 to 99% by weight of the resin composition and

copolymer (B) comprises 99 to 1% by weight of the resin composition. In addition, copolymer

(A) and copolymer (B) both have melt flow rates of 0.1 to 50 g/10 minutes (requirements (A-1)

and (B-1)). Further, (A-3) recites a composition distribution variation coefficient ("Cx") for

copolymer (A) that does not exceed 0.5. The Cx value is the ratio of the standard deviation of

composition distribution to the average branching degree of the copolymer. Also, (A-4) recites

that the copolymer (A) possesses a certain percent by weight of a cold xylene-soluble portion.

The percent by weight of a cold xylene-soluble portion must satisfy inequality (2) set forth in

claim 1. Also, claim 1 recites the requirement, (B-2), that the content of copolymer (B) having a

carbon-carbon double bond and an oxygen atom must not exceed 50% by weight based on the

weight of the sum of the ethylene unit and the unit of the compound having a carbon-carbon

double bond and an oxygen atom (i.e. "value (b)").

Mirabella discloses a polymeric composition wherein a first copolymer is comprised of

ethylene and a higher α-olefin having 3-12 carbon atoms and a second copolymer is comprised

of ethylene-vinyl acetate. Mirabella further discloses that the first copolymer comprises 60 to

95% by weight of the polymeric composition and that the second copolymer comprises 5 to 40%

by weight of the polymeric composition. Mirabella also discloses that the first copolymer has a

density of 0.880 g/cc and melt flow rate of 0.01 to 100 g/10 minutes. Further, Mirabella's

Example 3 describes an ethyl-vinyl acetate copolymer with a melt flow rate of 3.5 g/10 minutes.

Although, Mirabella teaches a polymer film that may satisfy (A-1) and (A-2), (A-3) and

(A-4) are not inherently met or satisfied. In other words, a polymer that might satisfy (A-1) and

(A-2) does not necessarily meet (A-3) and (A-4).

Several examples from the instant invention demonstrate that polymer may satisfy (A-1)

and (A-2) but fail to satisfy (A-3) and (A-4). *See* Table 1.

Comparative Example 2 is a polymer in which copolymer (A) consists of component

(A2). Component (A2) is produced by a Zieglar-Natta catalyst. Component (A2) meets (A-1)

and (A-2), but not (A-3) or (A-4).

Component (A1), on the other hand, does satisfy (A-1), (A-2), (A-3), and (A-4).

Component (A1) is produced by a metallocene catalyst. Note that Component (A1) and

Component (A2) are both ethylene-hexene-1 copolymer.

Therefore, (A-3) and (A-4) are not necessarily present in Mirabella. Accordingly,

Applicants respectfully submit that Claims 1-5 are not anticipated by Mirabella.

Applicants further assert that Claims 1-5 are not obvious over Mirabella. In order to establish obviousness, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one skilled in the art, to modify the reference. Applicants point out that Mirabella does not suggest that selection of an ethylene/α-olefin that satisfies (A-3) and (A-4) will produce a resin composition with the desired qualities.

Applicants also assert that Claim 6 is not anticipated by, or in the alternative, obvious over Mirabella. Claim 6 recites a resin composition wherein copolymer (A) is produced with a metallocene catalyst. Mirabella does not teach the use of a metallocene catalyst for producing a copolymer of ethylene and α-olefin. As discussed above, the use of the metallocene catalyst imparts the claimed requirements upon copolymer (A).

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,

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WASHINGTON OFFICE

23373

PATENT TRADEMARK OFFICE

Date: July 30, 2003

RESIN COMPOSITION AND FILM THEREOF

FIELD OF THE INVENTION

[01]   The present invention relates to a resin composition and a film thereof, which is low in glossiness, low in transparency, superior in tear strength, ~~of~~pliable with a silk cloth-like feel, and low in loudness when crumpled by hands.

BACKGROUND OF THE INVENTION

[02]   Many ~~of~~polyethylene films used ~~for the purpose such~~ as materials for packaging ~~use~~ ~~are desired to~~ have ~~a~~ high glossiness to obtain a superior appearance, ~~and a~~ high transparency to make packaged goods ~~well~~visible, as well as ~~superiority in~~ physical properties such as superior tear strength.

[03]   However, depending upon the application purposes, the high-glossiness and high-transparency are not required ~~to be high~~. When used for ~~application of~~ the packaging of sanitary goods such as tissue paper, diaper paper ~~diaper~~ and other goods, ~~of the body; ~~such as ~~application like~~ disposable rain wears, ~~and~~ medical sheets, ~~;~~ and ~~application like~~ polyethylene ~~made~~ gloves ~~readily~~used in places such as kitchens, factories, food stores, hotels' and hospitals, a polyethylene film is desired to be superior in tear strength, ~~and~~ in addition ~~thereto~~, low ~~in~~ glossiness, low ~~in~~ transparency, ~~of~~a pliable silk cloth-like feel, and low ~~in~~ loudness when crumpled by hand.

[04]   With respect to resin compositions and films ~~concerned~~ with which the present invention is concerned, JP-A 61-106645 discloses a film of a mixture of ethylene-vinyl acetate copolymer and polyethylene; JP-A 2-4846 discloses a film of a mixture of ethylene-(meth)acrylate copolymer and polyethylene; JP-A 7-292174 discloses a resin composition

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comprising ethylene-l-hexene copolymer obtained by using a metallocene catalyst and ethylene-vinyl acetate copolymer, and a film of said resin composition; and JP-A 8-283480 discloses a resin composition comprising ethylene copolymer obtained using a metallocene catalyst, ethylene-vinyl ester copolymer and an anti-blocking agent.

[05]   However, the films disclosed in JP-A 61-106645 and JP-A 2-4846 are not satisfactory ~~in the~~ with respect to the low-glossiness, low-transparency and tear strength, and the films of the resin compositions disclosed in JP-A 7-292174 and JP-A 8-283480 are too transparent~~high in transparency to satisfy the low-transparency~~.

SUMMARY OF THE INVENTION

[06]   An object of the present invention is to provide a film, which is low in glossiness, low in transparency, superior in tear strength, ~~of~~ pliable with a silk cloth-like feel, and low in loudness when crumpled by hands.

[07]   Another object of the present invention is to provide a resin composition capable of providing such a film.

[08]   The present invention provides a resin composition comprising;

[09]   (A) from 1 to 99% by weight of a copolymer, which comprises an ethylene unit and an a -olefin unit of 3 to 12 carbon atoms and,

[10]   (B) from 99 to 1% by weight of a copolymer, which comprises an ethylene unit and a unit of a compound having a carbon-carbon double bond and an oxygen atom, provided that the sum of the copolymer (A) and the copolymer

[11]   (C) is 100% by weight, wherein the copolymer (A) satisfies the following requirements (A--1) to (A-4), and the copolymer (B) satisfies the following requirements (B-1) and (B-2),

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[12]   (A-1) : a melt flow rate (MFR) is from 0.1 to 50 g/10 min,

[13]   (A-2): a density (d) is from 880 to 935 Kg/m^3,

[14]   (A-3): a composition distribution variation coefficient (Cx) represented by the

following equation (1) is not more than 0.5,

$$Cx = \sigma/SCBave \qquad (1)$$

wherein σ is a standard deviation of composition distribution, and SCBave is an average

branching degree,

[15]   (A-4): a content (a) of cold xylene-soluble portion in terms of % by weight based on

the weight of the copolymer (A) and the density (d) satisfy the following inequality (2),

$$a < 4.8 \times 10^{-5} \times (950\text{-}d)^3 + 10^{-6} \times (950\text{-}d)^4 + 1 \qquad (2)$$

[16]   (B-1): a melt flow rate (MFR) is from 0.01 to 50 g/10 min, and

[17]   (B-2): a content (b) of a unit of a compound having a carbon-carbon double bond and

an oxygen atom in terms of % by weight based on the weight of the sum of the ethylene unit

and the unit of a compound having a carbon-carbon double bond and an oxygen atom, and a

content (WB) of the copolymer (B) in the resin composition in terms of % by weight based

on the weight of the sum of the copolymer (A) and the copolymer (B) satisfy the following

inequality (3),

$$50 > b > 0.2 \times WB + 10 \qquad (3).$$

[18]   The present invention also provides a film comprising the above-mentioned resin

composition.

DETAILED DESCRIPTION OF THE INVENTION

[19]   The copolymer (A) used in the present invention, which ~~copolymer~~ is, according to

circumstances, referred to as "component (A)", can be obtained by copolymerizing ethylene

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and at least one α-olefin of 3 to 12 carbon atoms. The above-mentioned "ethylene unit" means a structure unit derived from ethylene. Similarly, the above-mentioned " α-olefin unit of 3 to 12 carbon atoms" means a structure unit derived from said a-olefin.

[20]   Examples of the above-mentioned α-olefin are propylene, butene-1, pentene-1, hexene-1, heptene-1, octene-1, nonene-1, decene-1, dodecene-1, 4-methyl-pentene-1, 4-methyl-hexene-1 and vinylcyclohexane. Of these, preferred are butene- 1, hexene-1 and octene-1, and more preferred is hexene-1.

[21]   Examples of the copolymer (A) are ethylene-propylene copolymer, ethylene -butene-1 copolymer, ethylene -hexene -1 copolymer and ethylene-octene-1 copolymer. Of these, ~~preferred is~~ ethylene-hexene-1 copolymer is preferred.

[22]   A melt flow rate (MFR) of the copolymer (A) is from 0.1 to 50 g/i0 min, preferably from 0.5 to 20 g/10 min, more preferably from 0.5 to 10g/10 min, much more preferably from 2 to 5 g/10 min. When the melt flow rate is less than 0.1 g/10 min, ~~a too heavy load may be achieved when molding a~~the film from the obtained resin composition may be too heavy. When it exceeds 50 g/10 min, tear strength of the film obtained may decrease.

[23]   A density (d) of the copolymer (A) is from 880 to 935 Kg/m^3, preferably from 890 to 930 Kg/m^3, more preferably from 910 to 930 Kg/m^3. When the density is less than 880 Kg/m^3, rigidity of the film obtained may decrease, and as a result, the film may become unsuitable for packaging film from a viewpoint of a handling facility. When it exceeds 935 Kg/m^3, impact strength of the film obtained may decrease.

[24]   A composition distribution variation coefficient (Cx) represented by the above-mentioned equation (1) is not more than 0.5, preferably from 0.2 to 0.4. When the composition distribution variation coefficient exceeds 0.5, glossiness of the film in

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accordance with the present invention may increase, or tear strength and anti-blocking property thereof may deteriorate.

[25]   The composition distribution variation coefficient is a measure showing a distribution degree of the monomer unit in the copolymer (A). The smaller the Cx value, the narrower the composition distribution, in other words, the ethylene unit and the α-olefin unit are more uniformly distributed in the copolymer (A). A measurement method of the Cx value is mentioned hereinafter.

[26]   A content (a) (% by weight) of cold xylene-soluble portion and a density (d) of the copolymer (A) must satisfy the above-mentioned inequality (2). A copolymer (A) satisfying the following inequality (4) is preferred, and a copolymer (A) satisfying the following inequality (5) is more preferred.

$$a < 4.8 \times 10^{-5} \times (950\text{-}d)^3 + 10^{-6} \times (950\text{-}d)^4 \quad (4)$$

$$a < 4.8 \times 10^{-5} \times (950\text{-}d)^3 \quad (5)$$

[27]   When the copolymer (A) does not satisfy the above inequality (2), tear strength of the film in accordance with the present invention may decrease, glossiness thereof may increase or anti-blocking property thereof may deteriorate.

[28]   A process for producing the copolymer (A) is not limited. The copolymer (A) can be produced according to a conventional process using a conventional catalyst. As the conventional catalyst, those containing a transition metal compound ~~are exemplified~~could be used. A preferred conventional catalyst is that which ~~containing~~contains a transition metal compound having a cyclopentadiene type anion skeleton-carrying group, namely, a so-called metallocene compound. Amore preferred metallocene compound is represented by the following formula,

$$ML_cX_{n\text{-}o}$$
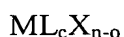
wherein M is a transition metal atom belonging to the group 4 or-the lanthanide series of the periodic table, L is a cyclopentadiene type anion skeleton-carrying group or a hetero atom-containing group, provided that at least one L is a cyclopentadiene type anion skeleton-carrying group, and plural L groups may be cross-linked with one another, X is a halogen atom or a hydrocarbon group of 1 to 20 carbon atoms, n is a valence of the transition metal atom, and c is an integer satisfying $0 < c \leq n$.

[29]   The above-mentioned transition metal compound may be used ~~each alone~~ individually or in a mixture of two or more.

[30]   The above-mentioned catalyst containing the transition metal compound can be obtained by ~~the following~~ combination (1) to combination (4).

[31]   (1) A combination of the transition metal compound with an organoaluminum compound such as triethylaluminum and triisobutylaluminum.

[32]   (2) A combination of the transition metal compound with an almoxane compound such as methylalmoxane.

[33]   (3) A combination of the transition metal compound, an organoaluminum compound such as triethylaluminum and triisobutylaluminum, and an ionic compound such as tolytyltetraxispentafluorophenyl borate and N,N-dimethylanilium tetraxispentafluorophenyl borate.

[34]   (4) A combination of the transition metal compound, an almoxane compound such as methylalmoxane, and an ionic Compound such as tolytyltetraxispentafluorophenyl borate and N,N-dimethylanilium tetraxispentafluorophenyl borate.

[35]   Such a catalyst may be supported on a carrier comprising particulate inorganic carriers such as SiO_2 and Al_2O_3, and particulate organic polymers such as polyethylene and polystyrene.

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[36]   As a polymerization method of the copolymer (A), for example, solution

polymerization, slurry polymerization, high-pressure ion polymerization and gas phase

polymerization methods ~~are enumerated~~may be used. Of these, gas phase polymerization and

high-pressure ion polymerization methods are preferred.

[37]   The "copolymer (B) comprising an ethylene unit and a unit of a compound having a

carbon-carbon double bond and an oxygen atom and" used in the present invention, which is,

according to circumstances, referred to as "component (B)", means a copolymer comprising

an ethylene unit and a structure unit derived from a compound having a carbon-carbon double

bond and an oxygen atom, which ~~compound is~~copolymerizable with ethylene.

[38]   Examples of the compounds providing the unit of a compound having a carbon-

carbon double bond and an oxygen atom are α,β-unsaturated carboxylic acid alkyl esters

such as methyl acrylate, ethyl acrylate, butyl acrylate, methyl methacrylate, ethyl

methacrylate and butyl methacrylate; carboxylicacidvinyl esters such as vinyl acetate, vinyl

propionate, vinyl butanate and vinyl benzoate, and vinyl ethers such as methyl vinyl ether,

ethyl vinyl ether and phenyl vinyl ether. Of these, ~~preferred are~~methyl acrylate, ethyl

acrylate, butyl acrylate, methyl methacrylate and vinyl acetate are preferred.

[39]   A melt flow rate of the copolymer (B) is from 0.01 to 50 g/10 min, preferably from

0.1 to 20 g/10 min, more preferably from 1.5 to 10 g/10 min. When the MFR is less than 0.01

g/10 min, its compatibility with the copolymer (A) may deteriorate. When it exceeds 50 g/

10 min, tear strength of the film in accordance with the present invention may decrease.

[40]   A content (b) (% by weight) of a unit of a compound having a carbon-carbon double

bond and an oxygen atom in the copolymer (B), and a content (WB) (% by weight) of the

copolymer (B) in the resin composition in accordance with the present invention must satisfy

the above inequality (3), preferably the following inequality (6), wherein b (% by weight) is

based on 100% by weight of the sum of a content of an ethylene unit and a content of a unit of a compound having a carbon-carbon double bond and an oxygen atom, and WB (% by weight) is based on 100% by weight of the sum of contents of the copolymers (A) and (B) in the resin composition in accordance with the present invention.

$$50 > b > 0.7 \times WB + 10 \qquad (6)$$

[41]   A̶ The value of b (% by weight) is less than 50% by weight as shown in the above inequalities (3) and (6), preferably not more than 40% by weight, more preferably not more than 30% by weight. When the value of b is not less than 50% by weight, tear strength of the film in accordance with the present invention may decrease. On the other hand, the value of b exceeds 0.2 x WB + 10, preferably 0.7 x WB + 10. When the value of b is not more than 0.2 x WB + 10, glossiness of the film in accordance with the present invention may increase-

[42]   A process for producing the copolymer (B) is not particularly limited. For example, ethylene and the compound having at least one carbon-carbon double bond and an oxygen atom are subjected to copolymerization in the presence of a radical generator under conditions o̶f̶ from 50 to 400 MPa and from 100 to 300°C, and, if desired, in the presence of a solvent and a chain transfer agent, which is called a high-pressure radical polymerization method. An average molecular weight of the copolymer (B) and contents of respective units contained in said copolymer can be controlled by adjusting the polymerization conditions.

[43]   The resin composition in accordance with the present invention comprises from 1 to 99% by weight of the copolymer (A) and from 99 to 1% by weight of the copolymer (B) , preferably from 60 to 99% by weight of the copolymer (A) and from 40 to 1% by weight of the copolymer (B), more preferably from 70 to 99% by weight of the copolymer (A) and from 30 to 1% by weight of the copolymer (B), much more preferably from 85 to 994 by

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weight of the copolymer (A) and from 15 to 1% by weight of the copolymer (B), provided that the sum of the copolymer (A) and the copolymer (B) is 100% by weight.

[44]   When the content of the copolymer (A) is less than 1% by weight, glossiness of the film comprising the resin composition may increase, or impact strength thereof may decrease. When the content of the copolymer (A) exceeds 99% by weight, glossiness of said film may increase, or a film of pliable silk cloth-like feel may not be obtained.

[45]   The film in accordance with the present invention is a non-oriented film obtained by using the resin composition in accordance with the present invention. The film in accordance with the present invention has a haze value (an index of non-transparency) of preferably more than 20%, more preferably not less than 30%. The film in accordance with the present invention has a gloss value (an index of glossiness) of preferably less than 30%, more preferably not more than 25%, much more preferably not more than 15%.

[46]   A process for producing the resin composition in accordance with the present invention is not particularly limited. For example, the resin composition can be obtained according to a conventional blending method. According to the conventional blending method, for example, the copolymer (A) and the copolymer (B) are subjected to dry ~~blend~~ blending using a blender such as Henschell mixer and a tumbler mixer, or to melt ~~blend~~ blending using a mixer such as a single screw extruder, a twin screw extruder, Bumbury's mixer and a hot roll.

[47]   A process for producing the film in accordance with the present invention is not particularly limited, and may be a conventional one. As the conventional process, a tubular film process using a tubular film forming apparatus and a T die casting process using a T die cast film forming apparatus ~~are exemplified~~can be used. Of these, a tubular film process is preferred.

[48]   The film in accordance with the present invention can be used as at least one side surface layer of a multi-layer film. As materials of the other layer (substrate) constituting the multi-layer film, for example, cellophane, paper, cardboard, cloth, aluminum foil, polyamide resin such as nylon 6 and nylon 66, polyester resin such as polybutylene terephthalate polybutylene terephalate, and oriented polypropylene ~~are enumerated~~may be used.

[49]   A process for producing said multi-layer film is not particularly limited, and may be a conventional one. ~~As the process, there is exemplified a~~ A process wherein the resin composition in accordance with the present invention and the above-mentioned material for the substrate are subjected to co-extrusion or extrusion coating, wherein the latter process is also called an extrusion laminating process. Alternatively, the multi-layer film can be obtained, for example, by laminating the film in accordance with the present invention (single layer film) on the above-mentioned substrate according to lamination processes such as dry lamination, wet lamination, sandwich lamination and hot melt lamination.

[50]   The film in accordance with the present invention and the above-mentioned multi-layer film can be particularly suitably used as materials for producing a film used for packaging sanitary goods such as tissue paper, paper diaper and goods of the body, and materials for producing a glove readily used in places such as kitchens, factories, food stores, hotels and hospitals.

[51]   A process for producing a glove is not particularly limited. For example, the glove can be produced according to a conventional process wherein two sheets of the film are placed one over the other, thereafter the periphery of the superimposed is heat-melt-bonded along a shape of hand, and then a portion corresponding to a wrist is made open.

[52]   If desired, the components (A) and (B) used in the present invention may be used in combination with additives such as antioxidants, lubricants, antistatic agents, processing improvers and anti-blocking agents.

[53]   Examples of the antioxidants are phenol antioxidants such as 2,6-di-t-butyl-p-cresol(BHT),tetraxis[methylene-3-(3,5-di-t-butyl-4-hydroxy-henyl) propionate]methane (a trade mark of IRGANOX 1010, manufactured by Ciba Specialty Chemicals K.K.) and n-octadecyl-3-(4'-hydroxy-3,5'-di-t-butylphenyl)propionate (a trade mark of IRGANOX 1076, manufactured by Ciba Specialty Chemicals K.K.); and phosphite antioxidants such as bis(2.4-di-t-butylphenyl)pentaerythritoldiphosphite and tris(2,4-di-t-butylphenyl) phosphite.

[54]   Examples of the lubricants are erucic amide, higher fatty acid amides and higher fatty acid esters. Examples of the antistatic agents are glycerol C_8 to C_{22} fatty acid ester, sorbitan C_8 to C_{22} fatty acid ester and polyethylene glycol C_8 to C_{22} fatty acid ester. Examples of the processing improvers are metal salts of fatty acids such as calcium stearate. Examples anti-blocking agents are silica, diatomaceous earth, calcium carbonate and talc.

[55]   A process for combining the copolymer (A) and the copolymer (B) with the additive is not limited. For example, the additive is added to a mixture of the copolymer (A) and the copolymer (B), or separately added to each one of the copolymer (A) and the copolymer (B). Alternatively, the additive may be added to a master batch of the copolymer (A) or the copolymer (B).

Example

[56]   The present invention is explained with reference to Examples, which are not intended to limit the scope of the present invention.

[57]   The following components (A1) to (A3) were used, and 15 characteristics thereof are as shown in Table 1.

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Component (A1)

[58]　　　　Ethylene-hexene-1 copolymer, a trade mark of SUMIKATHENE E FV403,

manufactured and sold by Evolue Japan Co., Ltd. and Sumitomo Chemical Co., Ltd.,

respectively.

Component (A2)

[59]　　　　Ethylene-hexene-1 copolymer, a trademark of SUMIKATHENE α FZ201-0,

manufactured by Sumitomo Chemical Co., Ltd.

Component (A3)

[60]　　　　Ethylene-butene-1 copolymer, a trade mark of SUMIKATHENE I. FS240,

manufactured by Sumitomo Chemical Co., Ltd.

[61]　　　　The following components (B1) to (B5) were used, and characteristics thereof are as

shown in Table 2.

Component (B1)

[62]　　　　Ethylene-vinyl acetate copolymer, a trade mark of EVATATE 10 H2011,

manufactured by Sumitomo Chemical Co., Ltd.

Component (B2)

[63]　　　　Ethylene-vinyl acetate copolymer, a trade mark of EVATATE H2031, manufactured

by Sumitomo Chemical Co., Ltd.

Component (B3)

[64]　　　　Ethylene-methyl methacrylate copolymer, a trade mark of ACRYFT WK307,

manufactured by Sumitomo Chemical Co., Ltd.

Component (B4)

[65]   Ethylene-vinyl acetate copolymer, a trade mark of EVATATE D2021F, manufactured by Sumitomo Chemical Co., Ltd.

Component (B5)

[66]   Ethylene copolymer produced according to a high pressure process, a trade mark of SUMIKATHENE F-200-0, manufactured by Sumitomo Chemical Co., Ltd.

[67]   Physical properties described in Examples and Comparative Examples were measured as follows.

1.   Density (d) (Kg/m^3)

[68]   It was measured according to a process prescribed in JIS K6760.

2.   Melt flow rate (MFR) (g/10 min)

[69]   It was measured at 1901 under a load of 2.16 kg according to a process prescribed in JIS K6760.

3.   Composition distribution variation coefficient (Cx)

[70]   It was measured by using a multifunction LC (Liquid Chromatography) manufactured by Tosoh Corporation according to a process comprising the following steps (1) to (7).

[71]   (1) A sample is dissolved in o-dichlorobenzene (ODCB) heated at 145°C to obtain a solution having a concentration of

0.2 g/20 ml.

[72]   (2) The solution is introduced in a column of a column oven, in which sea sand is filled.

[73]   (3) A temperature of the oven is lowered from 145°C to 125°C at a rate of 40°C/60 minutes, and further lowered from 125°C to -15°C over 14 hours.

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[74]　　　　　(4) The temperature of the oven is raised from -15°C to 125°C at a rate of 10°C/60

minutes, and a relative concentration of the sample in the solution continuously effused from

the column during the temperature-raising process is measured with use of an FT-IR

connected to the column. Here, the relative concentration is measured 7 times at equal

intervals during the time that the oven temperature is raised by 10°C (for example, during the

time that the oven temperature is raised from -15°C to -5°C), and a final temperature of the

measurement is fixed to be a temperature (about 97°C) at which the SCB value according to

the following equation (7) is found to be almost 0. The reason why the oven temperature is

raised to 125°C is to ~~perfectly~~ completely effuse the sample from the column.

[75]　　　　　(5) On the other hand, a branching degree (SCB) per 1000 carbon atoms of a principal

chain in each temperature (each effusion temperature) at which the relative concentration is

measured is determined from the following equation (7) regardless of a kind of the

comonomer.

$$SCB = -0.7322 \text{ x effusion temperature (°C)} +70.68 \qquad (7)$$

[76]　　　　　(6) With respect to each temperature at which the relative concentration is measured,

the branching degree obtained in the above item (5) and the relative concentration obtained in

the above item (4) are plotted to enter the horizontal axis and the vertical axis, respectively,

thereby obtaining a curve (composition distribution curve).

[77]　　　　　(7) From the curve, an average branching degree per 1000 carbon atoms (SCBave)

and a standard deviation (σ) of composition distribution are obtained, and from the

following equation (1), a fluctuation coefficient (Cx) of composition distribution is

determined.

$$Cx = \sigma/SCBave \qquad (1)$$

[78]   Here:

[79]   Average branching degree (SCBave.) = $\Sigma N(i) \times W(i)$

[80]   Standard deviation (σ) of composition distribution

[81] $= \{ \Sigma (N(i) - SCBave.)^2 \times W(i) \}^{0.5}$

[82]   N(i): Branching degree at No. i measuring point.

[83]   W(i): Relative concentration at No. i measuring point ($\Sigma W(i) = 1$) .

4.   Content of cold xylene-soluble portion (a) (% by weight)

[84]   t was measured according to a process prescribed in § 175.1520 of U.S. Code of Federal Regulations, Food and Drugs Administration.

5.   Haze value (%)

[85]   It was measured according to a process prescribed in ASTM D1003. The larger the value, the lower the transparency.

6.   Gloss value

[86]   It was measured according to a process prescribed in JIS Z8741. The smaller the value, the lower the glossiness.

7.   Content of unit of compound having carbon-carbon double bond and oxygen atom in the copolymer (B) (% by weight)

[87]   (1) A content of vinyl acetate unit was measured according to a process prescribed in JIS K6730-1981.

[88]   (2) A content of methyl methacrylate unit was measured according to the following process.

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[89]   The copolymer (B) was pressed to obtain a sheet of 0.3 mm thickness, and an infrared

absorption spectrum of the sheet was measured using an infrared spectrophotometer, FT/IR-

7300 Type, manufactured by JASCO Corporation. Using a peak of 3448 cm-1 attributed to

methyl methacrylate as a characteristic absorption, a content of the methyl methacrylate unit

was determined from the following equation (9) comprising compensation for the absorbancy

by the thickness. In this equation, I is an intensity of transmitting light at 3448 cm^{-1}, I_0 is an

intensity of incident light at 3448 cm^{-1}, and t (cm) is a thickness of the sheet.

Content of methyl methacrylate unit (% by weight)

$$=4.1 \times \log (T_0/I) /t-5.3 \qquad (9)$$

8.   Tear strength (kN/m)

[90]   It was measured according to a process prescribed in ASTM D1922.

Examples 1 to 7

[91]   Components shown in Table 3 were mixed in blending proportions shown in that

Table with a tumbler mixer. Using a film molding machine composed of a 50 mm ϕ

extruding machine and a blow molding machine (diameter of die = 120 mmϕ, lip opening =

2.0 mm), manufactured by Placo Co. Ltd., the resulting mixtures were processed under

conditions of a processing temperature of 140°C, an output of 25 kg/hr and a blow ratio of

2.3, thereby obtaining respective non-oriented films of 60 μm thickness. Physical properties

of the films are as shown in Table 3. The films obtained were found to have a pliable silk

cloth-like feel and to be low in loudness when crumpled by hands.

Comparative Examples 1 to 4

[92]   The same manner as in Examples was repeated, except that components shown in

Table 4 were used in blending proportions shown in that Table, thereby obtaining respective

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non-oriented films. Each thickness of the films obtained in Comparative Examples 1 to 3 was 60 μm, and a thickness of the film obtained in Comparative Example 4 was 50 μm. Physical properties of the films are as shown in Table 4.

[93]   From Table 3, it is apparent that the films obtained in Examples 1 to 7 are low in their glossiness, low in transparency and superior in their tear strength.

Contrary thereto, Table 4 demonstrates as follows.

[94]   1. Comparative Example 1, wherein the requirement (B-2) is not satisfied, reveals high glossiness and high transparency.

[95]   2. Comparative Example 2, wherein the requirements (A-3) and (A-4) are not satisfied, reveals high glossiness and high transparency.

[96]   3. Comparative Example 3, wherein the requirement (A-3) and (A-4) are not satisfied, reveals high glossiness, high transparency and insufficient tear strength.

4. Comparative Example 4, wherein the requirement (B-2) is not satisfied, reveals high transparency.

Table 1

Components	Requirements (A-1) to (A-4) for component (A)				
	(A-1)	(A-2)	(A-3)	(A-4)	
	MFR (g/10 min)	$d(Kg/m^3)$	Cx	a(wt%)	Right side of equation (2)
(A1)	4.0	920	0.36	1.0	3.1
(A2)	2.0	912	0.57	9.2	5.7
(A3)	2.0	919	0.78	8.7	3.6

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Table 2

Components	Requirements (B-1) and (B-2) for component (B)	
	(B-1):MFR(g/10 min)	(B-2) : b (wt%)
(B 1)	3.0	15
(B2)	1.5	19
(B3)	7.0	25
(B4)	1.5	10
(B5)	1.9	0

Table 3

Examples	1	2	3	4	5	6	7
Components							
(A1)	90	95	90	70	95	90	70
(B1) (b=15 wt%)	10	-	-	-	-	-	-
(B2) (b=19 wt%)	-	5	10	30	-	-	-
(B3) (b=25 wt%)	-	-	-	-	5	10	30
Diatom earth	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Erucic amide	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Requirement (B-2)							
0.2 x WB+10 (Note 1)	12	11	12	16	11	12	16
0.7 x WB+10 (Note 2)	17	13.5	17	31	13.5	17	31
Properties of films							
Haze (%)	36	65	60	33	58	56	38
Gloss (%)	24	10	12	23	11	12	22
Tear strength (kN/m)	151	151	149	107	146	141	120

Note 1 : Right side of equation (3)

Note 2 : Right side of equation (6)

Table 4

Comparative Examples	1	2	3	4
Components				
(A1)	90	-	-	90
(A2)	=	90	-	-
(A3)	-	-	90	-
(B2) (b=19 wt%)	-	10	10	-
(B4) (b=10 wt%)	10	-	-	-
(B5) (b=0 wt%)	-	-	-	10
Diatom earth	0.5	0.5	0.5	0.5
Erucic amide	0.15	0.15	0.15	0.15
Requirement (B-2)				
0.2 x WB+10 (Note 1)	12	12	12	-
0.7 x WB+10 (Note 2)	17	17	17	-
Properties of films				
Haze (%)	24	26	28	7
Gloss (%)	48	39	37	-
Tear strength (kN/m)	148	168	78	-

Note 1 : Right side of equation (3)

Note 2 : Right side of equation (6)

WHAT IS CLAIMED IS:

1. A resin composition comprising:

(A) from 1 to 99% by weight of a copolymer, which comprises an ethylene unit and an α-olefin unit of 3 to 12 carbon atoms, and

(B) from 99 to 1% by weight of a copolymer, which comprises an ethylene unit and a unit of a compound having a carbon-carbon double bond and an oxygen atom, provided that the sum of the copolymer (A) and the copolymer (B) is 100% by weight, wherein the copolymer (A) satisfies the following requirements (A-1) to (A-4), and the copolymer (B) satisfies the following requirements (B-1) and (B-2),

(A-1): a melt flow rate (MFR) is from 0.1 to 50 g/10 min,

(A-2): a density (d) is from 880 to 935 Kg/m^3,

(A-3); a composition distribution variation coefficient (Cx) represented by the following equation (1) is not more than 0.5,

$$Cx = \sigma/SCBave \qquad (1)$$

wherein σ is a standard deviation of composition distribution, and SCBave is an average branching degree,

(A-4): a content (a) of cold xylene-soluble portion in terms of % by weight based on the weight of the copolymer (A) and the density (d) satisfy the following inequality (2),

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$$a < 4.8 \times 10^{-5} \times (950\text{-}d)^3 + 10^{-6} \times (950\text{-}d)^4 + 1 \qquad (2)$$

(B-1): a melt flow rate (MFR) is from 0.01 to 50 g/10 min, and

(B-2); a content (b) of a unit of a compound having a carbon-carbon double bond and an oxygen atom in terms of % by weight based on the weight of the sum of the ethylene unit and the unit of a compound having a carbon-carbon double bond and an oxygen atom, and a content (WB) of the copolymer (B) in the resin composition in terms of % by weight based on the weight of the sum of the copolymer (A) and the copolymer (B) satisfy the following inequality (3),

$$50 > b > 0.2 \times W8 + 10 \qquad (3).$$

2. A film comprising the resin composition according to Claim 1.

3. The film according to Claim 2, wherein a haze value of the film is more than 20%, and a gloss value thereof is less 25 than 30%.

4. The film according to Claim 2, wherein the film is for packaging sanitary goods.

5. A glove comprising the resin Composition according to Claim 1.

ABSTRACT OF THE DISCLOSURE

There is provided a resin composition comprising;

(A) from 1 to 99% by weight of a copolymer, which comprises an ethylene unit and an α-olefin unit of 3 to 12 carbon atoms, and satisfies the specific requirements (A-1) to (A-4), and

(B) from 99 to 1% by weight of a copolymer, which comprises an ethylene unit and a unit of a compound having a carbon-carbon double bond and an oxygen atom, and satisfies the specific requirements (B-1) and (B-2).